Remarks

Applicant submits this Preliminary Amendment prior to examination of the application to clean up the specification and Figure 1. No new matter has been added.

Conclusion

Applicant respectfully requests examination of the pending application at the earliest possible time.

Respectfully submitted,

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231 on September 5, 2002.

Darla Cleveland Date: September 5, 2002

APPENDIX A

Version with markings to show changes made to the specification

Marked up amended paragraph beginning on page 8, line 10:

--In one rolling code system employing one or more forward windows, such as that used by at least one Genie® brand of garage door openers, a rolling code receiver accepts and is actuated by (i) the current received code in the rolling code sequence, (ii) a single code within a small forward window of the code sequence, or (iii) two separate codes within a big forward window of the code sequence. In some cases, [such as with the at least one Genie® brand of garage door openers,] the two codes within the big forward window must fall within a predetermined number of each other along the code sequence in order to be accepted by the receiver. This predetermined number may be referred to hereinafter as the "code pair spread." For convenience, any rolling code system that employs one or more forward windows, [such as the Genie® system,] will also be referred to hereafter as following the forward window model. One feature of [a Genie®] one type of a rolling code receiver that employs a forward window model is that, once a receiver accepts a transmitted code, the receiver's current operating code becomes the accepted code.--

Marked up amended paragraph beginning on page 8, line 24:

By way of a non-limiting example, suppose the current code for a [Genie®] rolling code receiver is 700, the small forward window size is 10, the big forward window size is 5000, and the code pair spread size is 10. Suppose now that a transmitter transmits code 708 in the code sequence. Since this code is in the small forward window, the rolling code receiver will accept the code and actuate a device (e.g., open/close a garage door, arm/disarm a security system or car alarm, etc.). The new operating code of the rolling code receiver will be 708, meaning that it will now expect code 709 in the code sequence for the next activation. The rolling code receiver calculates each code using a secret algorithm.

Marked up amended paragraph beginning on page 9, line 16:

--In another rolling code system, which employs code windows, such as that used by at least one Chamberlain® brand of garage door openers, both forward and backward windows are utilized. In this model, the rolling code receiver accepts (i) the current code, (ii) any code in the code sequence falling within the forward window, or (iii) any other two sequential codes, so long as the two sequential codes do not fall within the previous X number of codes along the code sequence. In at least one such type of a [Chamberlain®] rolling code receiver, the receiver updates its current operating codes to the last accepted code. For convenience, this type of code window system will also be referred to hereafter as following a forward/backward window model. In yet another rolling code system, only a single forward window may be employed, without using a second forward window or a backward window.--

Marked up amended paragraph beginning on page 10, line 11:

--Figure 2 is a flow diagram illustrating an exemplary process 200 for determining a set of codes for controlling a rolling code receiver, according to one embodiment. Referring to Figure 2, process 200 begins at decision block 205 where a determination is made as to whether or not a rolling code receiver follows a forward window model[, such as one of the Genie® rolling code systems]. This may be accomplished, for example, by either knowing the type of receiver or through experimentation. If the rolling code receiver follows a forward window model, then the size(s) of the one or more forward windows are determined at block 210. This may be accomplished by sequentially capturing codes transmitted from a subject rolling code transmitter to a corresponding rolling code receiver and observing the receiver's response. In one embodiment, codes may be captured using a conventional "code grabber." In another embodiment, codes may be captured using a computer, coupling output and input ports of the computer to the rolling code transmitter, and utilizing software on the

computer to sequentially actuate the transmitter and read each sequentially transmitted code. More specifically, an output signal line or port of a computer (e.g., printer port) is coupled to a control input terminal of a relay (e.g., solid state relay). The output terminals of the relay are coupled across a switch of the rolling code transmitter used to actuate the transmitter. An input signal line or port of the computer is coupled to an output signal line of the rolling code transmitter. A simple software routine, script, etc. may be utilized to sequentially activate the relay (and thus the transmitter) and then read back the corresponding transmitted code via the input port. Since different rolling code transmitters (of the same manufacturer and/or different manufacturers) may have different timing requirements, the software must be configured to account for the different timing requirements. This embodiment facilitates the capture of many codes of the rolling code transmitter in a short period of time. Other embodiments may be utilized to capture codes.--

Marked up amended paragraph beginning on page 11, line 13:

--It has been observed that in at least one [Genie®] forward window model rolling code system, a small forward window contains 15 codes and a big forward window contains 16384 codes. It should be appreciated, however, that other systems may employ one or more forward windows each spanning a larger or smaller number of codes. The process of determining the small and big forward windows for [in] one type of [Genie®] rolling code system will be discussed in more detail below with reference to Figures 3 and 4. At block 215, the total number of possible codes in the code sequence is determined, if not already done so in block 210. By way of illustration, one [Genie®] rolling code system has a total of 65,536 codes.--

Marked up amended paragraph beginning on page 11, line 22:

--Once the number of forward window(s) (and the size(s) of the forward window(s)) and the total number of possible codes are determined, one or more regions along the code

sequence can then be identified (block 220), where a region spans some subset of codes along the total code sequence. In one embodiment, the size of each region is equal to the size of the big forward window. For example, at least one [Genie®] rolling code receiver can be divided into four equal regions of 16384 codes per region to total 65,536 codes. In another embodiment, the size of each region is a function of the size of the big forward window and a predetermined number. According to yet another embodiment, the size of each region is a function of the size of the big window and the small window. In yet another embodiment, the maximum region size is the size of the big window plus the size of the small window. The process of dividing the code sequence into regions will be described in more detail below with reference to Figure 5.--

Marked up amended paragraph beginning on page 12, line 10:

--At block 225, one or more codes are captured in each region. In the case of a [Genie®] rolling code system having both small and big forward windows, a pair of codes is captured for each region where each pair is within the code pair spread. In one embodiment, the code pair spread is equal to the size of the small forward window (e.g., 15 [for one Genie® brand]). However, the code pair spread may be equal to any value, smaller or larger than the small forward window. In one embodiment, a code pair is identified in each region such that the first code of a code pair in a subsequent region is within the big forward window of the second code in a code pair in the immediately previous region, and so on. As will be discussed in more detail below, this overlapping may be done to minimize the number of times the transmitter needs to be activated until it provides an acceptable code to a rolling code receiver. The identified code pairs may be captured by cycling the rolling code transmitter through the code pattern sequence and capturing the identified code pairs. At that point the code pairs form a set of codes in a code table (e.g., code table 164 [in the case of one Genie® system]) that may be loaded into NV memory 160 of transmitter 100.--

Marked up amended paragraph beginning on page 13, line 1:

--If, on the other hand, it is determined, at block 205, that the rolling code receiver does not follow the forward window model, the process 200 continues to decision block 230. At block 230, a determination is made as to whether the receiver follows a forward/backward window model[, such as that used by one Chamberlain® system]. If so, process 200 moves to block 235 where the size of the forward window is determined. As with block 210 above, this may be done by sequentially capturing codes transmitted from a rolling code transmitter to a corresponding rolling code receiver and observing the receiver's response.--

Marked up amended paragraph beginning on page 14, line 7:

--Once the size of the forward window is determined, the process 200 continues to block 240 to determine the size of the backward window. As mentioned above, the backward window contains a specific number of codes preceding the current code. In this embodiment, the forward/backward type rolling code receiver will not accept any code contained in the backward window. As with the forward window, the size of the backward window can be determined by capturing a series of sequential codes transmitted from a rolling code transmitter to a corresponding rolling code receiver and observing the receiver's response through a trial-and-error process. For example, in one rolling code system following a forward/backward window model, [manufactured by Chamberlain®,] the rolling code receiver will accept any two sequential codes which do not fall within the backward window.—

Marked up amended paragraph beginning on page 14, line 18:

--Once the forward and backward window sizes have been determined at blocks 235 and 240, respectively, the appropriate fixed activation codes may be captured and stored in a code table of a transmitter. For example, in one [Chamberlain®] rolling code system, the

minimum number of fixed codes needed to operate the rolling code receiver is three. The first two codes can be any two sequential codes along the sequence of possible codes. The third code should be at least the size of the backward window from the second of the sequential codes.--

Marked up amended paragraph beginning on page 15, line 1:

--For example, suppose the size of the forward window is 5000 and the size of the backward window is 300. Suppose also that the two sequential codes chosen are codes 1 and 2, although any other two codes could have been chosen. In this case, the third code should be at least code 303 to avoid the backward window. For sake of illustration, the third code is selected to be code 500. Thus, the transmitter will operate the rolling code receiver by sending only fixed codes 1, 2 and 500 in sequence when activated. When the [Chamberlain®] system is first activated the receiver will expect code 1 and the transmitter will transmit code 1. The next time, the receiver will expect code 2 and the transmitter will transmit code 2. Thereafter the receiver will expect code 3, but the transmitter will send code 500. Since this is within the forward window, the receiver will accept the code and actuate the device. At this point the receiver will next expect 501, but the transmitter will send fixed code 1. While the receiver will not accept the last 300 codes due to its backward window, code 1 is not considered to be in the backward window (i.e., it is more than 300 codes prior to current code 500 along the code pattern sequence). Moreover, since code 1 is not within the forward window (i.e., within the next 5000 codes), it must be followed by a second sequential code, or in this case fixed code 2. Thus, by sending code 2 along with or after code 1, the fixed code transmitter will activate the receiver. It should be appreciated that codes 1 and 2 may be sent simultaneously, separated by a discrete time period (e.g., signal lag), or sent individually as the transmitter is activated (e.g., code 1 is sent when user activates the transmitter, then code 2 is sent when the user again activates the transmitter).--

Marked up amended paragraph beginning on page 15, line 24:

--In one embodiment, these three fixed codes are captured and stored in the [Chamberlain®] code table 162 in NV memory 160 of fixed code transmitter 100. Thereafter, the transmitter 100 may be activated, using input(s) 140, to control a [Chamberlain®] rolling code receiver having a total of 2^32 possible code combinations with only three fixed codes.--

Marked up amended paragraph beginning on page 16, line 3:

--Referring back to decision block 230, if a determination is made that the receiver does not follow a forward/backward window model [(e.g., such as at least one Chamberlain® system)], then the process moves to block 250 to determine the size and orientation e.g., forward and/or backward, etc.) of any code window(s) recognized by the rolling code receiver. Again, this may be accomplished through a trial-and-error process whereby codes transmitted from a rolling code transmitter to a corresponding rolling code receiver are captured while monitoring the receiver's response. In general, forward windows may be detected as described above with reference to blocks 210 and 235, and backward windows may be detected as also described above with reference to block 240.--

Marked up amended paragraph beginning on page 16, line 23:

--Figure 3 is a flow diagram of a process 300 for determining the small forward window of at least one type of [Genie®] rolling code receiver, according to one embodiment. This process begins at block 310 where codes 1 through X of the [Genie®] rolling code transmitter are captured by sequentially actuating the transmitter and capturing the corresponding code. The value of X can range between 2 and the total number of possible code combinations. However, since most small forward windows will tend to be of a relatively small size, it may be desirable to capture only a few codes at first. At block 320, the [Genie®] rolling code transmitter/receiver system may optionally be synchronized, if

needed. This may be done by, for example, resetting the system. Also at block 325, a variable i is set to zero. If reset, the first time the transmitter is actuated it will transmit code 1, which is the same code the receiver is expecting. At block 330, the rolling code transmitter transmits code 1, which is received and accepted by the rolling code receiver. At block 340, the transmitter transmits the next expected code plus the current value of i (initially zero). Thus, the transmitter transmits code 2, which is the same code the receiver is expecting. At block 350, a determination is made as to whether the receiver accepted the transmitted code (e.g., code 2). If so, the process continues to block 360 where i is incremented by one. Now i is equal to 1. Returning to block 340, the transmitter transmits code 4, which is the code corresponding to the next expected value (i.e., 3) plus the value of i (i.e., 1). Again, at block 350 a determination is made as to whether the receiver accepted code 4 even though the receiver was expecting code 3. If so, the small window is at least 2 codes wide. The process continues to block 360 where the value of i is again incremented to a value of 2. Block 340, 350, and 360 are sequentially executed until the receiver fails to accept the transmitted code (at block 350). In such case, the process moves to block 370 where the value of the small window is determined, which is equal to the current value of i+1. It should be appreciated that other processes for determining the value of the small window may be used. Moreover, rather than starting the process 300 at code 1, the process could have been started at any other code number within the possible code sequence.--

Marked up amended paragraph beginning on page 18, line 3:

--Figure 4 illustrates a flow diagram of a process 400 for determining a big forward window of at least one type of [Genie®] rolling code receiver, according to one embodiment. Referring to Figure 4, at block 405, a plurality of specific codes from the [Genie®] transmitter are captured. In one embodiment, these codes represent codes 1 through 16,384, although another amount may also be captured depending on the estimated size of the big window.--

Marked up amended paragraph beginning on page 18, line 9:

--At block 410, both the transmitter and receiver may be synchronized, if necessary, which may be done by resetting both the transmitter/receiver pair. The next code the receiver expects in the sequence of codes will be referred to as the "n_code". When the system is reset, n_code is equal to 1. Also, at block 410, a variable k is set to i, where i is the size of the small window determined by process 300 (Figure 3). At block 415, a pair of codes (n_code+k and n_code+k+1) is transmitted to the [Genie®] rolling code receiver. For example, assuming the value of the small window (i) is 15, the transmitter transmits codes 16 and 17, while the receiver expects code 1. If, at decision block 420, the receiver does not respond, the small window is the same size as the big window and process 400 continues to block 440. If, on the other hand, the receiver responds to codes 16 and 17, the process 400 continues to block 425 where k is incremented by 1. The next expected code by the receiver is 18, which is the new value of n_code. At block 430, the transmitter transmits a pair of codes (n_code+k and n_code+k+1), which are codes 34 (18+16) and 35 (18+17), to the receiver. If, at block 435, it is determined that this code pair is accepted by the receiver, then the big window is at least 16 codes wide. Blocks 425, 430, and 435 are sequentially executed until the receiver fails to respond to the code pair (at decision block 435). At that point, the value of k will equal the size of the big window. In one [Genie®] rolling code receiver, the value of the big window is 16,384 codes wide.--

Marked up amended paragraph beginning on page 19, line 8:

--Referring now to Figure 5, a pie diagram containing one embodiment of a layout of possible receiver activation codes is depicted. This embodiment follows at least one [Genie®] forward window model rolling code system and is provided for illustration purposes. In this [Genie®] rolling code system, there are 65,536 possible rolling code combinations. That is, this rolling code transmitter-receiver pair each contain a code

generator which uses a secret algorithm to produces a sequence of 65,536 possible code patterns. As discussed above, when such a receiver is first activated, it will expect to receive code pattern 1. Similarly, the associated transmitter will send code pattern 1 the first time it is used since both the receiver and transmitter are functioning with the same type code generator.--

Marked up amended paragraph beginning on page 19, line 18:

--In the embodiment of Figure 5, code pattern 1 is shown as being the current position of the [Genie®] receiver. This exemplary embodiment assumes there are 65,536 possible code combinations, a small forward window that is 15 codes wide, a big forward window that is 16384 codes wide, and that the code pair spread is equal to the small forward window. Since the current code position of the receiver is 1, the [Genie®] receiver will accept any single code between 1 and 15 (small window size of 15). In addition, it will accept any code pair between 16 and 16384 (big window size of 16,384), so long as the codes in the code pair satisfy the code pair spread. If, on the other hand, a code pair outside of the big window is transmitted by the transmitter, the rolling code receiver will simply ignore the code pair. Similarly, a code pair transmitted within the big forward window but more than 14 codes apart will also be ignored by the receiver.--

Marked up amended paragraph beginning on page 20, line 6:

--In order to determine the minimum number of fixed code pairs which can be used to operate this [Genie®] receiver, the field of all possible code combinations (i.e., 65,536) is divided into four regions as shown in Figure 5. By doing this, it can be seen that code pairs may be select from between the solid region lines and the dotted region lines to minimize the number of code pairs. In other words, in this embodiment, a minimum of four fixed code pairs can be selected to operate the rolling code receiver, so long as the first code in the first code pair is selected from codes 1 to 15, the first code in the second code pair is selected

from codes 16385 to 16399, the first code in the third code pair is selected from codes 32769 to 32783, and the first code in the fourth code pair is selected from codes 49,153 to 49167. In one embodiment, the following code pairs are transmitted for each press sequence:--

Marked up amended paragraph beginning on page 20, line 19:

--The above values may be stored in [the Genie®] code table 164 in NV memory 160 (Figure 1). When transmitter 100 is first activated, it will send the first code pair 1 and 3 using RF transmission circuit 170. The second time transmitter 100 is activated it will send the next code pair 16385 and 16387. Since code 16385 is within the big forward window of the last transmitted code (e.g., code 3 in the first code pair), this code pair will be accepted by the receiver and the receiver will actuate the device. The next time the transmitter is activated it will send the next code pair (32769 and 32771). Again, since the first code 32769 is within the big forward window of the previous code (code 16387 in the second code pair), this code pair will be accepted by the receiver. In this manner, the transmitter 100, using four code pairs, can be used to operate the [Genie®] rolling code receiver.--

Marked up amended paragraph beginning on page 21, line 10:

--Suppose now that the fixed code transmitter 100 and the [Genie®] rolling code receiver are not synchronized and that the receiver expects a random code number such as code 32,044, while the fixed code transmitter 100 is set to send the first code pair (e.g., 1 and 3). In this case, the transmitter would send codes 1 and 3, which would be ignored by the receiver. A user would then activate the transmitter 100 again causing the transmitter to transmit the second code pair (codes 16385 and 16387). However, since the second code pair is not within the big forward window of the expected code, this transmission will be ignored. A user would then activate the transmitter to transmit the third code pair (e.g., 32769 and 32771), which is within the big forward window for code 32,044. In this case the receiver would accept the code pair and be activated. Moreover, the transmitter and receiver are now

synchronized in that the next code the receiver will expect is 32772, while the next code pair which will be transmitted by the transmitter is 49153 and 49155. Since code 49153 is within the big forward window (within 16383) of the next expected code 32772, the code pair will be accepted by the receiver. Thereafter, the receiver's next expected code will jump to 49156, since the last code it accepted was code 49155. Now that the transmitter has come full circle, it will transmit codes 1 and 3 again. As with the last transmission, code 1 falls within the big forward window of the code the receiver is expecting (i.e., 49156), meaning that the receiver will accept the code pair containing codes 1 and 3.--

Marked up amended paragraph beginning on page 22, line 5:

--Referring now to Figure 6, a pie diagram containing another embodiment of a layout of possible receiver activation codes is depicted. This embodiment follows at least one [Chamberlain®] type of a forward/backward window model rolling code system, and is provided for illustration purposes. This particular [Chamberlain®] rolling code system has 2^32 (or 4,294,967,296) possible rolling code combinations.--

Marked up amended paragraph beginning on page 22, line 10:

--In the embodiment of Figure 6, it is assumed that the current position of the receiver is 1000. Moreover, this receiver has a backward window which is 300 codes wide (Region 1), and a forward window which is 4000 codes wide (Region 2). This receiver will accept any code in Region 2, no code in Region 1, and any two consecutive codes in Region 3. That being the case, a minimum of three codes may be used to fully operate the receiver. In one embodiment, these codes are 1, 2 and 1000. As explained in more detail below, these three codes can be used by the fixed code transmitter 100 to operate the [Chamberlain®] rolling code receiver. It should be appreciated that other code combinations may be used to operate the receiver.--

Marked up amended paragraph beginning on page 22, line 20:

--As seen from the embodiment of Figure 6, the current receiver position is 1000. However, instead of transmitting code 1001, as expected by the receiver, the transmitter will transmit codes 1 and 2. Since these are sequential codes in Region 3, the receiver will actuate the attached device. The receiver now expects code 3. However, instead of transmitting code 3, the transmitter will transmit code 1000. Since this would be in the forward window of the expected code 3 (forward window is 4000 codes wide), it will be accepted by the receiver. By cycling through these three fixed codes, the fixed code transmitter 100 can be used to operate this [Chamberlain®] rolling code receiver. It should be appreciated that many other fixed code combination could also be used to fully operate the receiver.--